Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

ART. II.—*Observations on the Preparation of Caoutchouc.* By E. SOLLY, ESQ.

THE many uses to which Caoutchouc is now applied, as well as its increasing importance as an article of trade, render it of peculiar interest, and more particularly so at the present time, from the circumstance that a new and abundant source of it in India has been lately pointed out. In the following observations I am anxious to draw attention to some facts which, though perhaps known to a few who have examined the subject with great attention, are generally unknown or overlooked.

Notwithstanding the numerous applications to which caoutchouc has been put, and the great degree of ingenuity which is displayed in the machinery by which it is rendered useful, comparatively but little attention has been paid to the mode in which it is prepared; as if this had not very considerable influence on the quality and strength of the caoutchouc. The manner in which it is usually obtained is by drawing off the sap from the trees which yield it, and allowing it to dry by exposure to the air. This process is varied in some degree in different countries, but the principle is the same in all. The caoutchouc which is brought over in the form of bottles, and which is that best fitted for manufacturing purposes, is made by covering a mould of clay with a thin layer of the sap, and as soon as that is dry, adding another layer of sap; by repeating this a sufficient number of times, the bottle acquires the requisite degree of thickness, the clay moulds are then broken, and the fragments shaken out. The thicker bottles of course consist of many layers, and in cutting them across, the separate layers may be very easily perceived, each being separated from the next by a very fine line of a different colour to the mass of the caoutchouc, and upon soaking one of these bottles in boiling water, it is frequently easy to separate the different layers composing it one from another. The larger and more solid masses of caoutchouc, which come from South America, &c., are prepared with less care, and are of a very confused texture, containing, besides large quantities of impurities of a mechanical nature, many different lines, holes, and cavities of various forms and sizes.

As the sap of all trees which yield caoutchouc contains a considerable quantity of other substances in solution, it is evident that by the process above described, the caoutchouc obtained must be, to a considerable extent, contaminated with impurities; and I believe proportionably deteriorated in quality. In the bottles this would have comparatively but little effect on the strength of the caoutchouc, but when pieces of any thickness are made, it must be evident that, as the caoutchouc dries, a considerable portion of these soluble matters must be inclosed in the substance of the caoutchouc, and they are, to a considerable extent, collected in the cavities which I have beforementioned. When a piece of fresh or recently imported caoutchouc is cut across, it is very common to find these cavities filled with a dark brown liquid; this is a strong solution of the impurities in question. On cutting across a piece of the new caoutchouc from Assam, of about one-fourth of an inch in thickness, I found cavities nearly equal in diameter to half the thickness of the whole piece which were full of this brown fluid. When caoutchouc is kept some time, the water in these cavities evaporates very slowly, and the caoutchouc becomes much stronger; but though the water is thus dissipated, the soluble matters which were previously held in solution are left, in a solid form, lining the interior of the cavities. On strongly pressing a piece of this porous caoutchouc so as to bring the sides of the cavities into complete contact, I have always found great difficulty in making them adhere together at all, and even when they did adhere, it was very feebly and they separated with the least force. The cause of this evidently is, that the lining of impurities prevents any adhesion taking place.

I have already stated that it is easy to separate the layers composing a bottle one from another. This may at first appear remarkable when we consider the great ease with which two pieces of caoutchouc, having clean surfaces, unite when they are pressed together; so perfect is the junction thus formed, that, when once united, the piece will tear anywhere quite as easily as at the joint. Indeed, pieces of new caoutchouc having clean surfaces, frequently unite merely by the pressure of their own weight, so as to become quite inseparable, and so perfect is this union, that upon it some of the most important and useful applications are founded. The process for cutting the bottles into thread for the manufacture of elastic fabrics, for which a series of most beautiful machinery is employed by the London Caoutchouc Company, would be of far less value if it were not for this property, and the facility with which the work-people join the ends of two pieces together; and the strength of the joint so made is a curious and highly interesting example of this adhesive power. It may, therefore, appear surprising that there should exist so little adhesion between the layers forming the bottles; but when the mode of preparation is taken into account, it is evident that the soluble contents of the sap must be collected into a very thin film between each layer of caoutchouc, and this will fully account for their want of perfect adhesion.

I do not know to what extent the formation of this film affects the manufacture of the bottles, but it is most probable that it has considerable influence, particularly in the drying of the separate layers of sap, as it must considerably lengthen the time occupied by that process. It is probably to save this loss of time, rather than to increase the weight of the bottles, that the native manufacturers sometimes roll the bottles in sand between each successive layer, as, by so doing, they would be enabled to complete the bottles in a much shorter space of time, though the value of the caoutchouc would be of course destroyed.

Mr. Howisson, in his account of the caoutchouc of the Urceolea, describes the sap of that tree as containing a peculiar substance, which, when he endeavoured to make bottles with the sap, formed a thin film upon the outside of each layer as soon as it had become dry; and which he found interfered very much with the application of a new layer, causing the sap to run and divide like water upon wax, and he accordingly supposed the substance to be of an oily nature. He however found that, by washing the newly-formed layer with soap and water, this substance was removed, and it was then easy to apply a fresh portion of sap.

As in these bottles the lines of imperfect adhesion all run in one direction, and are parallel with each other, they weaken the caoutchouc far less than if it were otherwise; but notwithstanding this, I think there can be no doubt that it would be much stronger without these separations.

Having endeavoured to show that these impurities must have considerable influence on the strength, and consequent value, of the caoutchouc, I shall detail some experiments which I have made, with a view to ascertain how far it was possible to remove these objectionable matters. From the nature of the substances in question, there seemed little hope of being able to remove them when once the caoutchouc had become incorporated into a solid mass; I therefore endeavoured to deprive the sap of the impurities which it contained. In order to do this, I mixed the sap with about three times its bulk of water, and after well agitating them together, left the mixture at rest for some hours; at the end of that time, the mixture had separated into two parts, the uppermost being the sap, which floated on the surface of the water like cream; in appearance it was hardly at all, but in properties it was very considerably, altered, the water having separated almost all the soluble impurities, and in consequence acquired a slight brown tinge. When thus purified, it has most of the properties of the crude sap, but it has less tendency to separate the caoutchouc which it contains in the solid form; and Mr. Faraday, who I find has also employed this process for purifying the sap, says, that when thus prepared it may be kept without undergoing any change for a long period of time. When a portion of caoutchouc, obtained from the unaltered sap, was submitted to pressure, I did not find that its porosity was diminished, and on extending it, those parts which contained many cavities being weak, soon gave way, and the piece broke. The caoutchouc obtained from the washed sap, though at first as porous as the other, became denser by pressure, and the sides of the cavities adhered together, and seemed stronger than that obtained from the unwashed sap. I mention these experiments with diffidence, because I had not a sufficient supply of sap to make the experiments on a fair scale, and because there may be circumstances with which I am unacquainted, and which might entirely preclude the application of a similar process on a large scale. Numerous attempts have been made to import into this country the sap of caoutchouc-trees in an unaltered state, (as it exists in a state of very fine division,) but hitherto they have almost all failed, as the sap, when it arrives in this country, is usually found to have undergone a considerable change, the caoutchouc having coagulated or separated in a solid form. From experiments made with the fresh sap, and also on portions from different countries which have spontaneously coagulated, the conclusion presents itself that the coagulation is occasioned entirely by changes in the composition of the other substances with which the caoutchouc is accompanied. When the sap coagulates spontaneously, the action is not a slow one, like crystallization, but evidently takes place with considerable rapidity, as the solid mass is usually very porous, and full of cavities. Indeed, it would be difficult to account for the spontaneous coagulation of the sap in any other manner, as caoutchouc is one of the most unchangeable and fixed substances known, whilst the substances with which it is associated are changeable, and easily undergo decomposition.

From these circumstances, it seems very plausible to suppose that, if the sap were purified by this process of washing, it would be a far more unchangeable substance than it is in its unaltered state, and that it might be imported with a considerable chance of success into this country.

In conclusion I would suggest, as an experiment well worthy of being tried on a large scale, the practical applicability of the process of washing the sap; for though the additional strength which might be acquired by the caoutchouc might not be such as to render it worth while to wash the sap for the purpose of forming it in India into useful shapes for the English manufacturers, yet in facilitating the importation of the sap itself, it is probable that its adoption would be attended with complete success.